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Causal Model of Research Competency via Scientific Literacy of Teacher and Student

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Abstract

Scientific literacy is a latent variable which affect research competency. Therefore, it's imperative for teachers to receive scientific literacy development in order to be used in the development of scientific literacy for students more effectively. The purpose of this research is to study casual model of research competency via scientific literacy of teacher and student. A qualitative method was used to validate the theoretical model. The results found that the theoretical model developed by the researcher is possible. Most of the experts agreed that scientific literacy is a variable that has an effect with research competency of teacher and student. The use of internet and computer skill of student and teaching method are both factor influencing to scientific literacy level.

Keywords: research competency, scientific literacy, mixed method research, research and development

1. Introduction

Research competency is a significant attribute that should be developed for all professionals. As professionals with knowledge, skills, and positive expression of research will understand the systematic thinking, analysis, and synthesis. This will lead to an academic development of all professions and enable the discovery of new knowledge and innovation, to assist in problem resolution systematically, and the knowledge can be further developed continuously (Arayapipat, 2010). Countries around the world focus on an importance of the research for education development and attempt to make teacher as researcher, and adapt the role of research as a core activity to enhance teaching and learning or research teaching process, including the development of academic competency in school on the basis of ongoing research (Jamornmarn, 1997). In Thailand, The National Education Act B.E.2542 (1999) And Amendments (Second National Education Act) B.E. 2545 (2002) set a goal for teachers to develop their own research capabilities and academic mission development by using research process (Wiratchai, 2007). Nevertheless, the study of education research in Thailand has shown that teachers have limited knowledge and skills in research (Chalardyam, 2001), this is in line with the research result of Goodnough (2001) and Gilbert and Smith (2003).

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Teachers need to have research knowledge as they are deficient of research and development in academic education, which is one of the reasons for current decline in the teachers' prestige (Pitiyanuwat, 1999). Therefore, the development of research competency for teachers is an imperative subject, especially with the action research which is an important research model for quality teaching and learning development of the best school with the teachers themselves. The action research will provide teachers with a systematic approach to work and improve teaching and learning, as well as verify, review, and consider their own work. The action research is therefore one of the key strategy of an educational reform to achieve the new paradigm of education and provide great benefit to the development of teachers' teaching and learning (Trakulworakul, 2005).

The level of research competency development is correlated with variables of scientific competencies called "Scientific Literacy", which related to some intellectual process. The important process is the logic, critical thinking and integration, changing of symbols (e.g. data entry in the table, conversion of table to chart), creating description and argument, and the communication on information based, model output, and the use of mathematics (The institute for the Promotion of Teaching Science and Technology, 2011). Such a process is consistent with the competencies of Best's researcher (1981) which specifies that researchers with competencies in knowledge, skills, attitude, and characteristics which are conducive to research, must have an ability in critical thinking, synthesis, capable of criticism, well predicted an answer, knowledgeable in the use of the scientific method and logic, able to criticize with logic, good interpersonal contact with others, as well as using the information as a basis for decision making. This shows that scientific literacy is a latent variable which affect research competency. Therefore, it is imperative for teachers to receive scientific literacy development in parallel with research competency development in order to be used in the development of science literacy for students more effectively. At the same time, students will also develop research competency at their level through scientific literacy. However, research in the past shown that the development of research competency for teachers focused on the development through various training process directly (Pachanawan, 2009; Tobua, 2011). There was no research used the development of scientific literacy with teachers initially and provided them an understanding to develop their students. Furthermore, science teachers who mostly developed in scientific literacy according to the curriculum, they are the key target group that should be facilitated and developed the teaching and learning process that promotes scientific literacy in parallel with the development of research competency. The significant and necessity above has interested the researcher to study the factors that affect scientific literacy of students, by a study of related research as well as interview with teaches, to develop casual model of scientific literacy that affects research competency to be used in the development of an appropriate teacher training models for further development in teaching and learning to their students.

2. Literature review

The education plan according to The National Education Act B.E.2542 (1999) And Amendments (Second National Education Act) B.E. 2545 (2002) focus on an important of the learners. The article 24, paragraph 5, stipulates the promotion of the development in learning together process between teachers and students, to encourage students to learn and competence through research based, as well as facilitate teachers to research and develop an appropriate learning model for learners of different educational levels, according to section 30, the education reform in the second decade (2009 – 2018), a vision was set to develop the people of Thailand to have a quality life-long learning. The development of scientific potential is a vital mission to the modern world of knowledge-based society. Sciences play an important role in present and future society as it associates with everyone in everyday life and work, including technologies, equipment, and products that are being used to facilitate human life and work. These are all the results of sciences combined with creativity and other disciplines. Science helps humans to develop the ways of thinking, to be reasonable, creative, analytical, criticism, with essential skills in knowledge research, an ability to resolve problems systematically, and making decision by using variety of information with verifiable evidence. Therefore, everyone needs the development of scientific literacy to understand

the nature and human-created technologies, able to apply the knowledge reasonably, creatively, and with moral, according to article 23 of The National Education Act B.E.2542 (1999) And Amendments (Second National Education Act) B.E. 2545 (2002) (Office of the Basic Education Commission, 2008).

The education reform in the second decade (2009 – 2018) set the main policy to drive the process of learning development and teacher development as a priority policy and implement as a national agenda to achieve strategic goals for the quality of people and education in Thailand to meet international standards. As for sciences, the aim of the achievement is to increase the Programmed for International Student Assessment (PISA) to meet at least an international average. At present, the result of sciences assessment of Thai children in 2009 was low, significantly below an international average by 76 points, and lagged behind the group of South East Asia countries participating the programmed, second to Indonesia only (The institute for the Promotion of Teaching Science and Technology, 2011). The result is a reflection that teachers and students need to be developed in science knowledge to enhance the quality of education in the country.

3. Research questions

What is the characteristic of casual model of research competency via scientific literacy of teacher and student ?

4. Objectives of research

To study casual model of research competency via scientific literacy of teacher and student

5. Definition used in this research

Research competency means knowledge and capability in research which are divided into 2 types;

Knowledge and capability of secondary teachers in classroom action research effectively, consists of 4 competencies: knowledge in classroom action research, skills in classroom action research, attitude and commitment in classroom action research and research ethics

Knowledge and capability of secondary students via scientific literacy, consists of 2 competencies: knowledge in scientific projects and skills in scientific projects

Scientific Literacy means competencies of the students to use scientific knowledge and thinking, consists of 3 competencies: identification of scientific issues, explanation in scientific phenomenon and usage of scientific evidence

6. Research Methodology

This research is a mixed-method research and development to study casual model of research competency via scientific literacy of teacher and student by study related research document examined by experts and interviewed with outstanding science teachers to obtain the casual model. The objective of this stage is to develop the casual model of research competency via scientific literacy of teacher and student. The study was divided into 2 parts:

Part one: study of research documents about research competency and scientific literacy, which consists of theoretical thinking about research competency, elements of research competency, measurement of research competency, process of research competency development, scientific literacy concept, definition and elements of scientific literacy, factors that affect scientific literacy. The study results will provide theoretical casual model of

research competency and scientific literacy which will be a theoretical model that need to be examined by experts, the criteria for the selection of 6 experts are as follows:

i. at least 5 years of experience in scientific curriculum and teaching

ii. at least 5 years of experience in research / classroom action research

Part two: interview with outstanding science teachers to study their concepts and lesson plan for the development of scientific literacy of teachers, the criteria are as follows:

i. at least 5 years of experience in secondary school teaching

ii. awarded outstanding secondary teacher in scientific learning from government agencies / private sectors within the past 5 years with a clear evidence, or

iii. awarded in the development of academic innovation in scientific teaching from government agencies / private sectors within the past 5 years with a clear evidence, or

iv. selected by agency to participate as a research teacher in different projects at a national level within the past 5 years

7. Findings

The study of related documents and research together with examination by experts in scientific study, scientific education, and the group of interviewed teachers found that the theoretical model developed by the researcher is possible. Most of the experts agreed that scientific literacy is a variable that has an effect with research competency of teacher and student. As for teacher, the experts saw that the development of research process for undergraduate teachers student shows that teachers in scientific teaching group will explicitly be able to develop the learning research process better than the other groups, better logical way of thinking and better research skills.

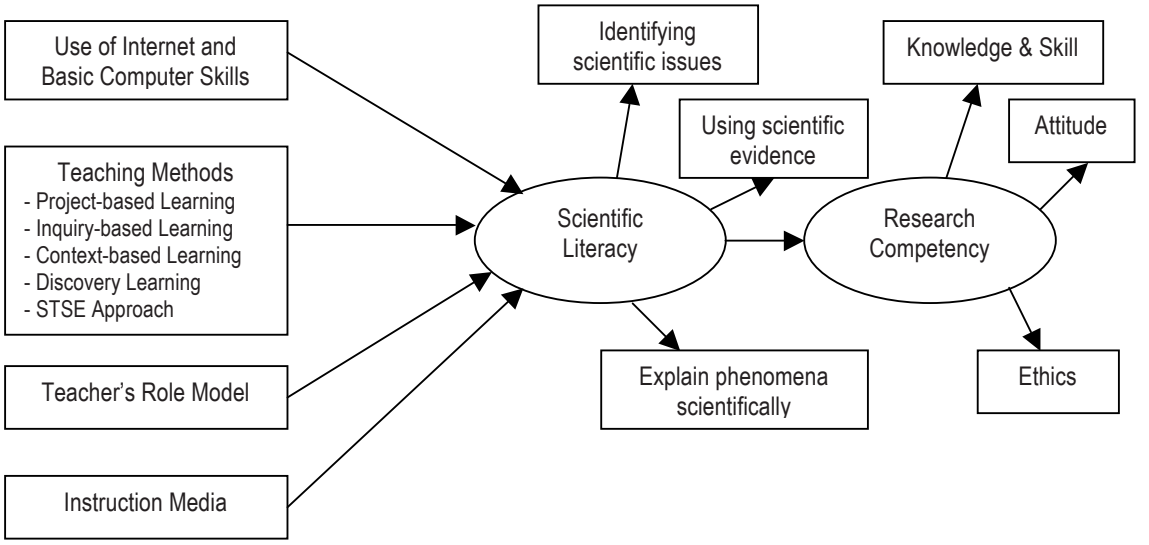

Figure 1. Causal model of research competency via scientific literacy

In addition, some of the experts suggested that the development for teachers' ability to develop scientific literacy of their student requires teacher to understand what scientific literacy is, what the elements are. Teachers need to have cognitive development before they start to develop their student, and teachers need to be a role model for their student. The implementation process should be video recording for reflection, including teaching journal, for teacher

to review and aware of areas for development. Since teacher is the most important person for this development and the search for appropriate teaching methods for learners is vital and is a key mechanism that will lead students to develop their scientific literacy through classroom learning process.

Most of the interviewed experts and teachers feel that the variable of internet usage and basic computer skills are possible factors that affect scientific literacy. Student will practice systematic thinking process while using computer and will be able to start searching information themselves with internet usage. Nevertheless, an access for student to computer without appropriate learning, verification, supervisory, monitoring, their learning process will not promote the above mentioned variable. In addition, most experts feel that teachers also require having that variable. Teacher needs to develop the instruction media that promotes scientific literacy to student. They also need to have an ability to research information, verify source of information, including the credibility of the source, to teach students more accurately and effectively than current situation.

Most experts agreed that teachers play a key role to drive scientific literacy which will lead to research competency. They feel that the variable of teachers' teaching method is a key factor. Teachers should use alternative teaching methods than scientific project-based learning, which is being used mostly by teachers in the scientific skills development process, however, it is not a method that enable scientific literacy. Teachers need alternative teaching methods such as context-based learning, discovery learning, STSE Approach, or Inquiry-based learning.

Most experts agreed that the suitable groups of student for an explicit success of scientific literacy development should be the higher elementary student to lower secondary student. Since this is an easy-to-develop age, children are ready to learn the skills, process, and able to develop scientific literacy well.

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References

Arthur, D. & Wong, F.K.Y. (2000). The effects of the 'learning by proposing to do' approach on Hong Kong nursing students' research orientation, attitude toward research, knowledge, and research skill. *Nurse Education Today*, 20, 662–671.

Berger, J. G., Boles, K. C. & Troen, V. (2005). Teacher research and school change: paradoxes, problems, and possibilities. *Teaching and Teacher Education***.** 21(1): 93-105.

Best, J.W. (1981). *Research in Education*. New Delhi: Prentice - Hall of India Private Limited.

Bland, C. J., and Schmitz, C. C. (1986). Characteristics of the successful researcher and implications for faculty development. *Journal of Medical Education***.** 61(3): 22-31.

Bryar, R. (2009). Getting there on research capacity building?. *Journal of Research in Nursing.*14(1), 5-7.

Chalardyam, W. (2001). The classroom research of elementary school teachers. Primary Educational Service Area Office (PESAO), Nong Bua Lam Phu. Master of Education Thesis, Education Administration, Graduate School, Khon Kaen University.

Donald, C., and Ian, M. (2009) Research capacity Building in teacher education: Scottish collaborative approaches. *Journal of Education for Teaching*. 35(4): 337-354.

Goodnough, K. (2001). Teacher development through action research: A case study of an elementary teacher. *Action in teacher Education, 23*(1): 37-46.

Gallagher, J., & Harsch, G.(1997). *Scientific literacy: Science education and secondary school students.* In W.Graeber & C. Bolte. (Eds.). Scientific literacy: An international symposium (p. 13-34). Institut für die Pädagogik der Naturwissenschaften (IPN): Kiel, Germany.

Gray, C. (2007). Research competencies framework. *Faculty of General Dental Practice(UK) The Royal College of Surgeon of England.* Hatfield, J. M., Hecker, K. G., Jensen, A. E. (2009). Building Global Health Research

Holbrook, J., Rannikmae M. (2009). The Meaning of Scientific Literacy**.** *International Journal of Environmental & Science Education,* 4 (3), 275-288.

Laugksch, R.C.,(2000). Scientific Literacy: A Conceptual Overview. *Science Education.* 84(1): 71-94.

Moore, J., Crozier, K. and Kite, K. (2012). An action research approach for developing research and innovation in nursing and midwifery practice: Building research capacity in one NHS foundation trust. *Nurse Education Today*. 32, 39-45.

Murray, J. et al. (2009). Research and teacher education in the UK: Building capacity. *Teaching and Teacher Education.* 25(1): 944-950.

Njie-Carr, V. et al. (2012). Research Capacity-Building Program for Clinicians and Staff at a Community-Based HIV Clinic in Uganda: A Pre/Post Evaluation. *Journal of The Association of Nurses in AIDS Care.* (in press), 1-11.

Pachanawan, A. (2009). The model of research competency development with participatory action research process. *Journal of Education* 20(2): 59-76; February - May 2009.

Priest, H., Segrott., J., Green, B., and Rout, A. (2007). Harnessing collaboration to build nursing research capacity: A research team journey. *Nurse Education Today*, 27, 577–587.

Pitiyanuwat, S. (1999). Report of an analysis in appropriate elements for teacher performance assessment. Bangkok: Office of the Teacher Civil Service and Educational Personnel Commission.

Rittima, A.. (2012). *Lecture Notes EGCE 421 Water Resource Engineering*. Available from: http://www.egmu.net/civil/areeya/EGCE421/EGCE421_Slides/EGCE421_Lecture13.ppt [2012, May 3].

The institute for the Promotion of Teaching Science and Technology (2011). 2009 PISA result in reading, mathematics, and science, management summary. Bangkok: Seven Printing Group.

Trakulworakul, K. (2005). *The influence of factors related to characteristics and action research of teacher to the research competency.* Master of Education Thesis, Education Research, Faculty of Education, Chulalongkorn University.